POLARHATION OF LYMAN-(x RADIATION FROM ATOMIC HYDROGEN EXCITED BY ELECTRON IMPACT FROM THRESHOLD TO 2000eV

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Polarization of atomic line radiation has been of general interest since its early discovery in the Zeeman Effect and polarization data yield valuable information on total cross sections for magnetic sublevel excitation of optically allowed transitions. Polarization measurements in the vacuum ultraviolet (VUV) present particular difficulties for experimentalists because the absence of suitable birefringent transmitting materials requires use of reflection devices which generally have low reflection coefficients. Chwirot and Slevin[1] and Uhrig et *al*[2] describe these problems in some detail,

Much of the available polarization data have been obtained by the Windsor group and refer to the rare gases and various molecules (see for example 1 Iammond et *al.*[3]). The only serious experimental study of the polarization of Lyman-a radiation from electron impact excitation of atomic hydrogen was carried out by Ott et *al*[4] using a LiF reflector and an oxygen filter and iodine vapor photon counter to isolate and detect the Lyman-α radiation. This experimental technique can be affected by the lack of precision in the wavelength definition and possible temporal deterioration in *the* LiF reflector due to the instability y of this material.

Wc report new measurements for the polarization of Lyman-α radiation from the decay of atomic hydrogen excited by electron impact from threshold to 2000 cV. Atomic hydrogen is generated by an intense discharge source and a Vuv monochromator provides accurate wavelength selection, a factor which is critical in quantifying the molecular contribution to the observed Lyman-α signal. Polarization is measured using a quartz reflection linear polarization analyzer (with a high transmittance and polarizance) mounted after the exit slit of the monochromator. Orientation of the monochromator is such that the plane defined by its entrance slit and optic axis is at 45° to the electron beam axis. 'l'his removes any polarization effects that may be induced by the monochromator and detector systems. The data we ol lain correspond to the integrated Stokes parameter S, defined as

S, : [I (0°) - I(90°)] / [1 (0°) + I (9091

where I (0") and 1 (90") are the photon intensities observed at 90° to the electron beam axis with electric vector parallel or perpendicular to the beam, respectively,

We will present data obtained with both electrostatic and magnetic electron guns. Our data will be compared with all available theories.

References:

1. S. Chwirot and J.A. Slevin, *Mess. Sci. Technol.* 4, 1305 (1993)
2. M. Uhrig, S. Hornemann, M. Klose, K. Becker and G.F. Hanne, *Mess. Sci. Technol.* 5, 1239 (1994)
3. P.Hammond, W. Karras, A.G.McConkey and J.W. McConkey, *Phys. Rev* A 40, 1804 (1989)
4. W.R. Ott, W.E. Kauppila and W.L. Fite, *Phys. Rev* A 1, 1089 (1970)

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